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Draft Report
Proposed Soil Cleanup Levels

Boeing–Plant 2
Seattle/Tukwila, Washington

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Submitted To:
The Boeing Company
Boeing Information Support Services
Safety, Health, and Environmental Affairs

December 1996

WESTON
MANAGERS DESIGNERS/CONSULTANTS

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1. INTRODUCTION

This report presents the proposed media cleanup levels (PMCLs) and point of compliance for soil at Boeing Plant 2 (the Facility) located at 7755 East Marginal Way South in Seattle, Washington. This report fulfills the requirements for a human health and environmental evaluation of the soil at the Facility under the Administrative Order on Consent (Order) issued by the U.S. Environmental Protection Agency (EPA) to The Boeing Company (Boeing) under the authority of Section 3008(h) of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended [42 USC 6928(h)]. The Order [RCRA Docket No. 1092-01-22-3008(H)], which became effective on 18 January 1994, identified activities necessary to correct or evaluate actual or potential threats to human health and/or the environment resulting form the release or potential release of hazardous constituents at or from the Facility. As required by the Order, this document proposes media cleanup levels for use in the Corrective Measures Study (CMS).

A health evaluation for upland soil at the Facility was prepared in May 1996 to identify the constituents of concern in upland soil and to assess the need for development of soil cleanup levels that are protective of human health (WESTON, 1996b). A groundwater human health and environmental evaluation has been conducted to develop proposed media cleanup levels and points of compliance for all hazardous constituents detected at levels of concern in Facility groundwater (WESTON, 1996a).

As a follow-up to the upland soil health evaluation, this report evaluates the soil to groundwater pathway for the identified constituents of concern (COCs) in the upland soil and proposes soil cleanup levels that are protective of groundwater quality at the Facility.

2. EXPOSURE PATHWAYS

2.1 Soil

As part of the RCRA Facility Investigation (RFI) Work Plan (WESTON, 1994), Boeing identified a process that would be followed to identify human health-based cleanup levels for upland soil. For the first step of the process, promulgated standards for soil were reviewed and found to be inapplicable to conditions at the Facility. Next, development of Facility-specific cleanup levels was pursued. However, since the site is completely paved or covered with buildings (except small landscaped areas) and there are comprehensive institutional controls in place, complete exposure pathways for direct contact with contaminated soil were not currently present and would not be present in the future. Based on the lack of potential exposure to contaminated soil, human health-protective cleanup levels for direct exposure to soil were considered to be inappropriate for the Facility (WESTON, 1996b).

2.2 Groundwater

The soil to groundwater pathway, however, was a potential exposure route for hazardous constituents in soil. Impacted soil exists at the Facility within three areas or zones. Releases at the surface may have affected soil in the vadose zone above the water table or may have migrated downward into the saturated zone. In some locations, particularly the southwest yard area, hazardous constituents may have been contained within fill materials both above and below the water table and adjacent to the Duwamish Waterway. Each area has implications for exposure pathways, effects on groundwater, and ultimately contributions to surface water in the Duwamish Waterway. The properties of the particular constituents of concern will also be critical in predicting subsurface fate and transport processes.

Where the COCs are found in the subsurface will determine their contribution of contaminants to the groundwater pathway and the environment. Contaminants that are in the vadose zone above the water table are less susceptible to leaching than soil in the saturated zone. Normally, contaminated soil that exists in a vadose zone might be considered susceptible to leaching by infiltrating water, causing mass transfer to the groundwater system. However, due to the presence of pavement, buildings, and institutional controls at the Facility, subsurface soil is isolated and leaching by infiltrating water is minimized. Some minor leakage from subsurface storm sewer drainpipes may occur, but will be limited to the vicinity of the pipes and the associated backfill materials. Therefore, contaminated soil above the water table can be considered relatively isolated from the groundwater system compared to soil below the water table.

Soil found below the water table is in constant contact with groundwater that migrates toward the Duwamish Waterway. Partitioning and leaching of constituents from contaminated soil to groundwater would be expected to occur in this area in proportion to the properties of the particular constituent of concern. This type of area is considered to be more relevant to groundwater remediation than the development of soil cleanup levels and will be considered while assessing groundwater remedies during the CMS.

Fill containing hazardous constituents both above and below the water table could potentially be subjected to leaching by infiltration, flushing by groundwater, and, if near the Duwamish Waterway, flushing by tidal fluctuations. COCs have been identified in a narrow strip of shoreline in the southwest yard area where these processes may be occurring.

Groundwater impacts at the Facility were described in the RFI Groundwater Human Health and Environmental Evaluation Report (WESTON, 1996a). Remedial measures to address impacted groundwater and off-site discharge of groundwater to the Duwamish Waterway will be evaluated during the CMS. In most cases, elevated constituent concentrations in soil are associated with groundwater contamination sources. Therefore, many areas of soil impact that are not protective of groundwater quality will be addressed through the groundwater remediation phase of the CMS. The proposed soil cleanup levels developed in this document will also aid design of appropriate groundwater remedies in the CMS.

3. CONSTITUENTS OF CONCERN

COCs for Facility soil are defined as all constituents detected in at least one soil sample, which includes 33 volatile organic chemicals, 37 semivolatile organic chemicals, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), and 27 metals. Soil COCs are listed in Table 1. Soil COC data are provided in the RFI Soil Investigation Interim Report (WESTON, 1996c).

4. PROPOSED SOIL CLEANUP LEVELS

Soil cleanup levels are proposed for the protection of human health and the environment via migration of COCs from soil to groundwater and ultimately to surface water receptors in the Duwamish Waterway adjacent to the Facility. The PMCLs for soil will not directly or indirectly violate state standards and federal criteria for the protection of surface water. The related media of concern at the Facility are groundwater and the surface water into which groundwater discharges. Groundwater at the Facility is not a potable drinking water source, as described in the RFI Groundwater Human Health and Environmental Evaluation Report (WESTON, 1996a). Therefore, protection of surface water quality in the Duwamish Waterway through acceptable groundwater quality is the primary objective for establishing PMCLs. EPA (40 CFR 131) and State of Washington surface water quality standards (WAC 173-201) are applicable to the Duwamish Waterway. These criteria/standards have been developed as generic, conservative values that are protective of aquatic life as well as humans who may be exposed due to consumption of fish.

In Washington state, WAC 173-340-740 (3)(a)(ii)(A) and WAC 173-340-745 (4)(a)(ii)(A) of the regulations implementing the Model Toxics Control Act (MTCA) require the setting of soil standards that are protective of groundwater quality, as follows:

> For individual hazardous substances or mixtures, concentrations that are equal to or less than one hundred times the ground water cleanup level established in accordance with WAC 173-340-720 unless it can be demonstrated that a higher soil concentration is protective of ground water at the site [WAC 173-340-740(3)(ii)(A)].

Recently, alternative methods for setting site-specific soil cleanup standards have been developed by the EPA (1996b). The Washington Department of Ecology (Ecology) is also preparing guidance for demonstrating that use of an alternative to its "one hundred times" soil-to-groundwater ratio is appropriate. Pending final Ecology guidance, the proposed cleanup levels for soil have been developed using the "one hundred times" approach in the MTCA regulations.

Accordingly, the following approach has been used to develop PMCLs:

i) Except for certain inorganics, proposed groundwater cleanup levels are multiplied by 100 to derive PMCLs for soil. The PMCLs for groundwater, as discussed in the RFI Groundwater Human Health and Environmental Evaluation Report (WESTON, 1996a), are based on the protection of water quality in the Duwamish Waterway. As described therein, PMCLs for groundwater are based on the lowest ambient water quality criteria among the following: marine acute criteria, marine chronic criteria, and human health-based criteria that are protective of human consumption of fish in the Duwamish Waterway. The PMCLs for groundwater also incorporate a dilution-attenuation factor that is appropriate for groundwater discharging to the Duwamish Waterway (a factor of 5,800). The PMCLs for both soil and groundwater are presented in Table 1.

ii) For inorganics, proposed soil cleanup levels will be based on regional background levels (Ecology, 1994), if the background levels are greater than the soil criteria developed from ambient surface water quality criteria. Site-specific background concentrations for soil could not be determined in the RFI because the entire Facility is underlain by anthropogenic fill. For calculated soil criteria that were less than the 90th percentile value for natural background concentrations found in the Puget Sound region, the background values were used as the PMCLs.

The resulting soil cleanup levels developed using the above method are shown in Table 1. With the exception of only a few constituents (i.e., 1,1,2-trichlorotrifluoroethane, 2-methyl naphthalene, carbazole, TPH), a PMCL has been developed for each COC detected in groundwater at the Facility. Regional background values were used as PMCLs for the following inorganic constituents: arsenic, chromium, copper, lead, mercury, nickel, and zinc.

5. PROPOSED POINT OF COMPLIANCE

The proposed point of compliance for soil at the Facility is the soil interval from a depth of zero to approximately 12 feet below ground surface (depth to groundwater). This interval was selected because it represents the soil vadose zone above the groundwater table and is potentially susceptible to leaching and translocating hazardous constituents to groundwater. Impacted soil below the water table will be handled as a groundwater issue in the CMS.

6. COMPARISON OF PLANT 2 SOIL DATA TO PROPOSED MEDIA CLEANUP LEVELS

All Facility soil data from a depth of zero to 12 feet below ground surface were compared to the PMCLs to determine those sample stations that exceeded the PMCLs and will therefore require further evaluation in the CMS. Table 2 identifies the COCs that exceeded the PMCLs as well as the number of samples that exceeded the proposed levels. Detection limits reported by the analytical laboratory for some analyses and constituents exceeded the PMCLs. As shown in Table 2, in cases where the reported detection limit was greater than the PMCL, the sample result was assigned a value of one-half the reported detection limit. If the half-detection-limit value was greater than the PMCL, it was designated to be a "possible exceedance." Therefore, a column of "possible exceedances" is included for those instances where sample detection limits exceeded the PMCLs.

As shown in Table 2, 3 VOC compounds, 22 semivolatile (BNA) compounds, several PCB mixtures, and 12 inorganic constituents exceeded the proposed soil cleanup levels. The frequency of exceedance of the PMCLs was less than 10 percent for all except the following constituents:

- Aroclor 1260
- Total PCBs
- Cadmium
- Chromium
- Copper
- Cyanide
- Lead
- Mercury
- Zinc

Map 1 presents those soil sample stations that have COC concentrations exceeding one or more PMCLs.

7. SUMMARY

At the Facility the primary pathway of exposure for soil contaminants is from the discharge of groundwater to surface water of the Duwamish Waterway. Human-health risk has previously been shown to be acceptable due to site pavement, buildings, and institutional controls acting as barriers preventing direct contact with contaminated soil (WESTON, 1994).

Proposed soil cleanup levels have been developed to limit impacts to groundwater quality that are based on the "one hundred times" soil-to-groundwater ratio from MTCA. The proposed soil cleanup levels were developed based on concentrations that are 100 times the groundwater concentrations calculated to protect the Duwamish Waterway (WESTON, 1996a). In cases where calculated criteria were less than regional background levels for soil, the background soil values were used.

These proposed soil cleanup levels will be used in the CMS to determine appropriate remedies to address contaminated soil and groundwater at the Facility. Other methods to modify site-specific soil cleanup criteria may be evaluated during the CMS once Ecology finalizes guidance on identifying site-specific soil-to-groundwater ratios appropriate for conditions at the Facility.

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Table 1—PMCLs for Soil Based on Groundwater Discharge to Duwamish Waterway

Constituent of Potential Concern	Acute WQC (µg/L)	Chronic WQC (µg/L)	Human Health WQC (µg/L)	5,800X HH WQC (µg/L)	Lowest Criteria (µg/L)	100X Lowest Criteria (mg/kg)	State Soil Background (mg/kg)	Soil PMCL (mg/kg)
VOCs								
1,1,1-Trichloroethane	31,200	--	1,030,000	6.0E+09	31,200	3,120	--	3,120
1,1,2,2-Tetrachloroethane	9,020	--	11	6.4E+04	9,020	902	--	902
1,1,2-Trichlorotrifluoroethane	--	--	--	--	--	--	--	NA
1,1,2-Trichloroethane	18,000	9,400	42	2.4E+05	9,400	940	--	940
1,1-Dichloroethane	--	--	518,961	3.0E+09	3.0E+09	3.0E+08	--	3.0E+08
1,1-Dichloroethene	224,000	--	3.2	1.9E+04	1.9E+04	1,856	--	1.9E+03
1,2-Dichloroethane	113,000	--	99	5.7E+05	1.1E+05	11,300	--	1.1E+04
1,2-Dichloroethene (total)	224,000	--	526	3.0E+06	224,000	22,400	--	22400
1,2-Dichloropropane	--	--	--	--	--	--	--	ND/NA
2-Butanone	--	--	285,949	1.7E+09	1.7E+09	1.7E+08	--	1.7E+08
2-Hexanone	--	--	--	--	--	--	--	ND/NA
4-Methyl-2-Pentanone	--	--	18,871	1.1E+08	1.1E+08	1.1E+07	--	1.1E+07
Acetone	--	--	49,423	2.9E+08	2.9E+08	2.9E+07	--	2.9E+07
Benzene	5,100	700	71	4.1E+05	700	70	--	70
Bromodichloromethane	12,000	6,400	15.7	9.1E+04	6,400	640	--	640
Bromoform	12,000	6,400	360	2.1E+06	6,400	640	--	640
Carbon Disulfide	--	--	7,180	4.2E+07	4.2E+07	4.2E+06	--	4.2E+06
Carbon Tetrachloride	50,000	--	4.4	2.6E+04	2.6E+04	2.6E+03	--	2.6E+03
Chlorobenzene	160	129	21,000	1.2E+08	129	12.9	--	13
Chloroethane	860,000	230,000	3,727	2.2E+07	230,000	23,000	--	23,000
Chloroform	28,900	1,240	470	2.7E+06	1,240	124	--	124
cis-1,2-Dichloroethene	224,000	--	1.85	1.1E+04	1.1E+04	1.1E+03	--	1.1E+03
Ethylbenzene	430	--	3,280	1.9E+07	430	43	--	43
Methylene Chloride	12,000	6,400	15.7	9.1E+04	6,400	640	--	640
Styrene	--	--	--	--	--	--	--	ND/NA
Tetrachloroethene	10,200	450	8.85	5.1E+04	450	45	--	45
Toluene	6,300	5,000	424,000	2.5E+09	5,000	500	--	500
trans-1,2-Dichloroethene	224,000	--	1,183	6.9E+06	224,000	22,400	--	22,400
Trichloroethene	2,000	--	81	4.7E+05	2,000	200	--	200
Trichlorofluoromethane	12,000	6,400	15.7	9.1E+04	6,400	640	--	640
Vinyl Chloride	224,000	--	525	3.0E+06	224,000	22,400	--	22,400
Total Xylene	--	--	--	--	--	--	--	NA
o-Xylene	--	--	35,989	2.1E+08	2.1E+08	2.1E+07	--	2.1E+07
m,p-Xylene	--	--	18,508	1.1E+08	1.1E+08	1.1E+07	--	1.1E+07
BNAs								
1,2,4-Trichlorobenzene	160	129	--	--	129	12.9	--	12.9
1,2-Dichlorobenzene	1,970	--	2,600	1.5E+07	1,970	197	--	197
2,4-Dimethylphenol	2,120	--	664	3.9E+06	2,120	212	--	212
2-Chloronaphthalene	7.5	--	--	--	7.5	0.75	--	0.75
2-Methylnaphthalene	--	--	--	--	--	--	--	ND/NA
2-Methylphenol	--	--	3,675	2.1E+07	2.1E+07	2.1E+06	--	2.1E+06
4-Chloro-3-methylphenol	30	--	--	--	30	3	--	3
4-Methylphenol	--	--	394	2.3E+06	2.3E+06	2.3E+05	--	2.3E+05
Benzo(b+k)fluoranthene	--	--	--	--	--	--	--	ND/NA
Benzoic acid	--	--	--	--	--	--	--	ND/NA
bis(2-Ethylhexyl)phthalate	400	360	50,000	2.9E+08	360	36	--	36
Butylbenzylphthalate	2944	--	--	--	2,944	294.4	--	294.4
Carbazole	--	--	--	--	--	--	--	NA
Di-n-butylphthalate	2900	--	154000	8.9E+08	2,900	290	--	290
Di-n-octylphthalate	--	--	0.00046	2.7E+00	2.7E+00	2.7E-01	--	2.7E-01
Dibenzofuran	--	--	6.2	3.6E+04	3.6E+04	3.6E+03	--	3.6E+03
Diethylphthalate	2,900	--	1,800,000	1.0E+10	2,900	290	--	290
Dimethylphthalate	--	--	2900000	1.7E+10	1.7E+10	1.7E+09	--	1.7E+09
Hexachlorobutadiene	32	--	50	2.9E+05	2.9E+03	2.9E+02	--	2.9E+02
N-Nitrosodiphenylamine	3300000	--	16	9.3E+04	9.3E+04	9.3E+03	--	9.3E+03
Phenol	5,800	--	6,862,542	4.0E+10	5,800	580	--	580
LPAHs								
Naphthalene	2,350	--	256	1.5E+06	2,350	235	--	235
Acenaphthylene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Acenaphthene	970	710	142	8.2E+05	710	71	--	71
Fluorene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01

Table 1—PMCLs for Soil Based on Groundwater Discharge to Duwamish Waterway

Constituent of Potential Concern	Acute WQC (µg/L)	Chronic WQC (µg/L)	Human Health WQC (µg/L)	5,800X HH WQC (µg/L)	Lowest Criteria (µg/L)	100X Lowest Criteria (mg/kg)	State Soil Background (mg/kg)	Soil PMCL (mg/kg)
Phenanthrene	7.7	4.6	0.0311	1.8E+02	4.6	0.46	--	0.46
Anthracene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Total LPAH	300	--	--	--	300	30	--	30
HPAHs								
Fluoranthene	40	16	54	3.1E+05	16	1.6	--	1.6
Pyrene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Benzo(a)anthracene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Chrysene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Benzo(b)fluoranthene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Benzo(k)fluoranthene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Benzo(a)pyrene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Indeno(1,2,3-cd)pyrene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Dibenzo(a,h)anthracene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Benzo(g,h,i)perylene	300	--	0.0311	1.8E+02	1.8E+02	1.8E+01	--	1.8E+01
Total HPAH	300	--	--	--	300	30	--	30
PCBs								
Aroclor 1016/1242	10	0.03	0.000045	2.6E-01	0.03	0.003	--	0.003
Aroclor 1242	10	0.03	0.000045	2.6E-01	0.03	0.003	--	0.003
Aroclor 1248	10	0.03	0.000045	2.6E-01	0.03	0.003	--	0.003
Aroclor 1254	10	0.03	0.000045	2.6E-01	0.03	0.003	--	0.003
Aroclor 1260	10	0.03	0.000045	2.6E-01	0.03	0.003	--	0.003
Aroclor 1262	10	0.03	0.000045	2.6E-01	0.03	0.003	--	0.003
Total PCB	10	0.03	0.0000079	4.6E-02	0.03	0.003	--	0.003
Total Inorganics								
Aluminum	--	--	4,297	2.5E+07	2.5E+07	2.5E+06	32581	2.5E+06
Antimony	1,500	500	4,300	2.5E+07	500	50	--	50
Arsenic	69	36	0.14	8.1E+02	36	3.6	7.3	7.3
Barium	--	--	292	1.7E+06	1.7E+06	1.7E+05	--	1.7E+05
Beryllium	--	--	0.117	6.8E+02	6.8E+02	6.8E+01	0.6	6.8E+01
Cadmium	43	9.3	2.1	1.2E+04	9.3	0.93	0.8	0.93
Calcium	--	--	--	--	--	--	--	NA
Chromium	1,100	50	44	2.6E+05	50	5	48.2	48.2
Cobalt	--	--	249	1.4E+06	1.4E+06	1.4E+05	--	1.4E+05
Copper	2.9	ND	46	2.7E+05	2.9	0.29	36.4	36.4
Cyanide	1	--	220,000	1.3E+09	1	0.1	--	0.1
Iron	--	--	--	--	--	--	--	NA
Lead	140	5.6	--	--	5.6	0.56	16.8	16.8
Magnesium	--	--	--	--	--	--	--	NA
Manganese	--	--	100	5.8E+05	5.8E+05	5.8E+04	1146	5.8E+04
Mercury	2.1	0.025	0.146	8.5E+02	0.025	0.0025	0.07	0.07
Molybdenum	--	--	--	--	--	--	--	ND/NA
Nickel	75	8.3	4,600	2.7E+07	8.3	0.83	38.2	38.2
Potassium	--	--	--	--	--	--	--	NA
Selenium	300	71	17	9.9E+04	71	7.1	--	7.1
Silver	2.3	--	149	8.7E+05	2.3	0.23	--	0.23
Sodium	--	--	--	--	--	--	--	NA
Thallium	2,130	--	6.3	3.7E+04	2,130	213	--	213
Tin	--	--	--	--	--	--	--	ND/NA
Vanadium	--	--	29	1.7E+05	1.7E+05	1.7E+04	--	1.7E+04
Zinc	95	86	709	4.1E+06	86	8.6	85.1	85.1

Notes:

-- No data available for this constituent.

NA = No criteria available for constituent; constituent has been detected in groundwater.

ND/NA = No criteria available for constituent; constituent has NOT been detected in groundwater.

Acute and chronic criteria were based on Washington State water qualtiy criteria (WQC) for saltwater (WAC-173-201A).

In the absence of state standards, federal saltwater WQC were selected (40 CFR 131; EPA, 1996a).

If a freshwater criterion was available in the absence of acute or chronic saltwater criteria, it was used.

If criteria for multiple species of metals were available (i.e., tri- and hexavalent chromium), the more conservative criterion was selected.

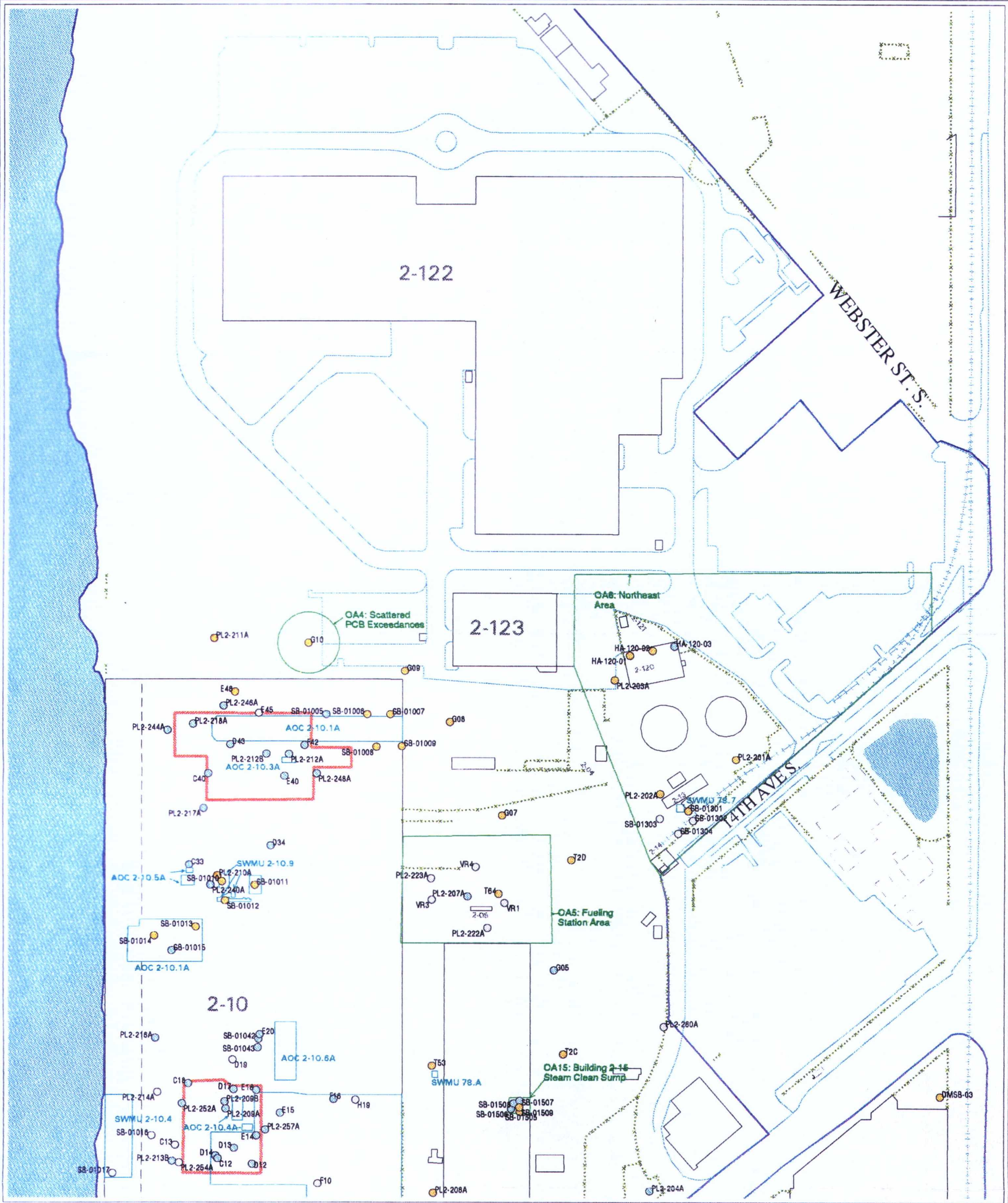
Human health criteria were based on federal WQC for the ingestion of aquatic organisms (40 CFR 131; EPA, 1996a).

Fish ingestion protective risk-based concentrations (RBCs) from EPA's Region III Risk-Based Concentration Table (EPA, 1996b) and literature-based fish bioconcentration factors (BCFs) were used in the absence of EPA-listed criterion.

Table 2—COCs That Exceed Proposed Media Cleanup Levels

Constituent	Number of Analyses	Possible Exceedances	Detected Exceedances	Proposed Media Cleanup Level (mg/kg)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
VOCs						
Ethylbenzene	817	3	3	43	0.0005	260
Toluene	817	1	1	500	0.0006	650
Trichloroethene	804	3	3	200	0.0007	11000
BNAs						
1,2,4-Trichlorobenzene	298	5	0	13	0.0700	0.31
2-Chloronaphthalene	298	7	0	1	ND	ND
4-Chloro-3-methylphenol	298	5	0	3	0.4700	1.3
bis(2-Ethylhexyl)phthalate	298	3	2	36	0.0081	520
Di-n-butylphthalate	298	1	1	290	0.0110	790
Di-n-octylphthalate	298	11	3	0	0.0200	900
Naphthalene	349	2	2	235	0.0130	520
Acenaphthylene	349	9	4	18	0.0700	240
Acenaphthene	349	0	0	71	0.0880	18
Fluorene	349	9	4	18	0.1000	180
Phenanthrene	349	24	18	0	0.0085	940
Anthracene	349	9	4	18	0.0096	240
Fluoranthene	349	16	11	2	0.0085	410
Pyrene	349	12	7	18	0.0095	550
Benzo(a)anthracene	349	10	5	18	0.0210	200
Chrysene	349	10	5	18	0.0079	240
Benzo(b)fluoranthene	349	10	5	18	0.0160	100
Benzo(k)fluoranthene	349	11	6	18	0.0150	160
Benzo(a)pyrene	349	10	5	18	0.0180	210
Indeno(1,2,3-cd)pyrene	349	7	2	18	0.0260	83
Dibenz(a,h)anthracene	349	6	1	18	0.0870	33
Benzo(g,h,i)perylene	349	8	3	18	0.0380	100
PCBs						
Aroclor 1248	545	545	15	0.003	0.035	90
Aroclor 1254	545	545	33	0.003	0.020	3
Aroclor 1260	545	545	76	0.003	0.015	310
Aroclor 1242	161	161	1	0.003	29.000	29
Aroclor 1016/1242	384	384	1	0.003	0.820	0.82
Aroclor 1262	9	9	9	0.003	0.022	1.6
Total PCB	581	581	127	0.003	0.018	310
Total Inorganics						
Antimony	482	7	7	50	5	576
Arsenic	757	62	58	7.3	0.73	76
Cadmium	794	112	112	0.93	0.10	7100
Chromium	794	120	120	48.2	1.60	72000
Copper	760	93	93	36.4	0.80	28100
Cyanide	248	216	102	0.1	0.11	4600
Lead	801	107	107	16.8	0.917	17300
Mercury	727	94	94	0.07	0.04	30
Nickel	745	60	60	38.2	1.0	1770
Selenium	701	15	8	7.1	0.024	9
Silver	721	92	69	0.23	0.10	274
Zinc	761	114	114	85.1	3.6	31000

Note: In some cases, reported sample-specific detection limits exceeded specific PMCLs. For this comparison, the sample concentration was assigned a value of one-half the reported detection limit. Thus, a column of possible (i.e., undetected) exceedances is included in this table.

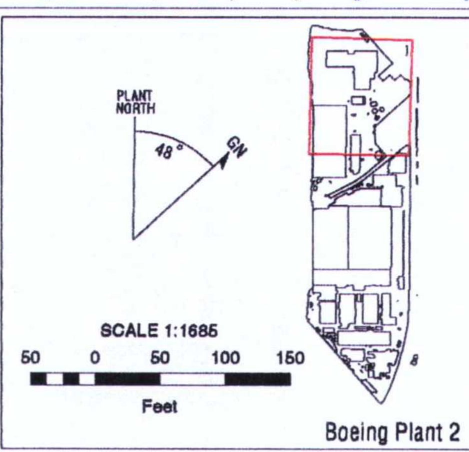


BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment

SYMBOL EXPLANATION

- Non-Detect
- Soil locations not exceeding PMCLs
- Soil locations exceeding PMCLs
- SWMU/AOC
- Approx. located SWMU/AOC
- Other Area
- Other Area



NOTES

1) Historical and RFI Soil Depths: 0 - 12 feet

WESTON
MANAGERS DESIGNERS/CONSULTANTS

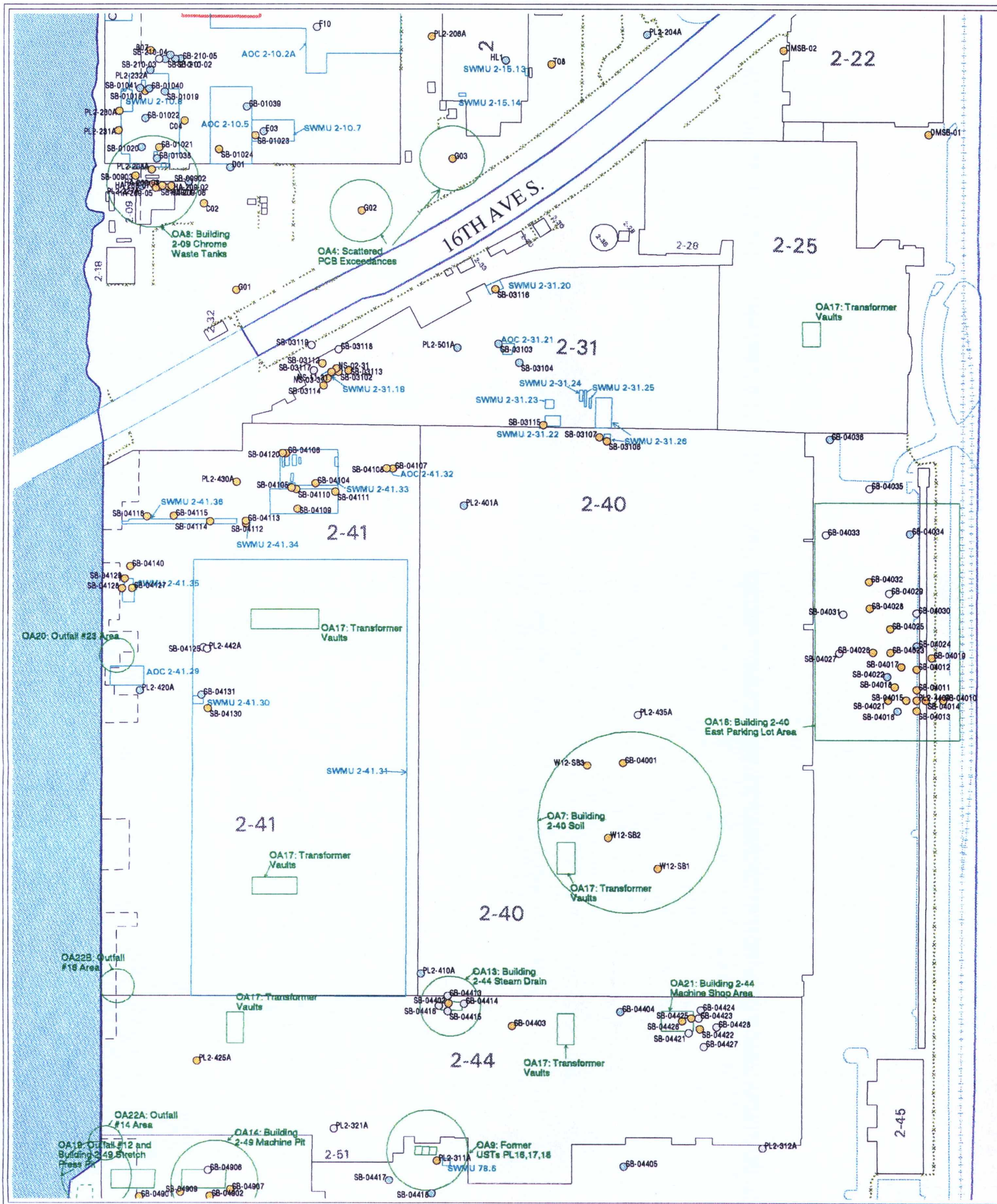
DATE: December 11, 1996 10:47 AM
JOB NUMBER: 03709-034-300-3810-02
LEAD GIS ANALYST: K. Palmer
VIEW FILE: default.view

CHECKED BY: ____________

APPROVED BY: KAP

Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Map 1a

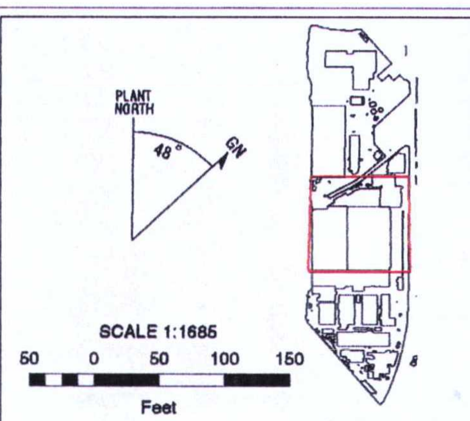


BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment

SYMBOL EXPLANATION

- Non-Detect
- Soil locations not exceeding PMCLs
- Soil locations exceeding PMCLs
- SWMU/AOC
- Approx. located SWMU/AOC
- Other Area
- Other Area



NOTES

1) Historical and RFI Soil Depths: 0 - 12 feet

WESTON MANAGERS DESIGNERS/CONSULTANTS

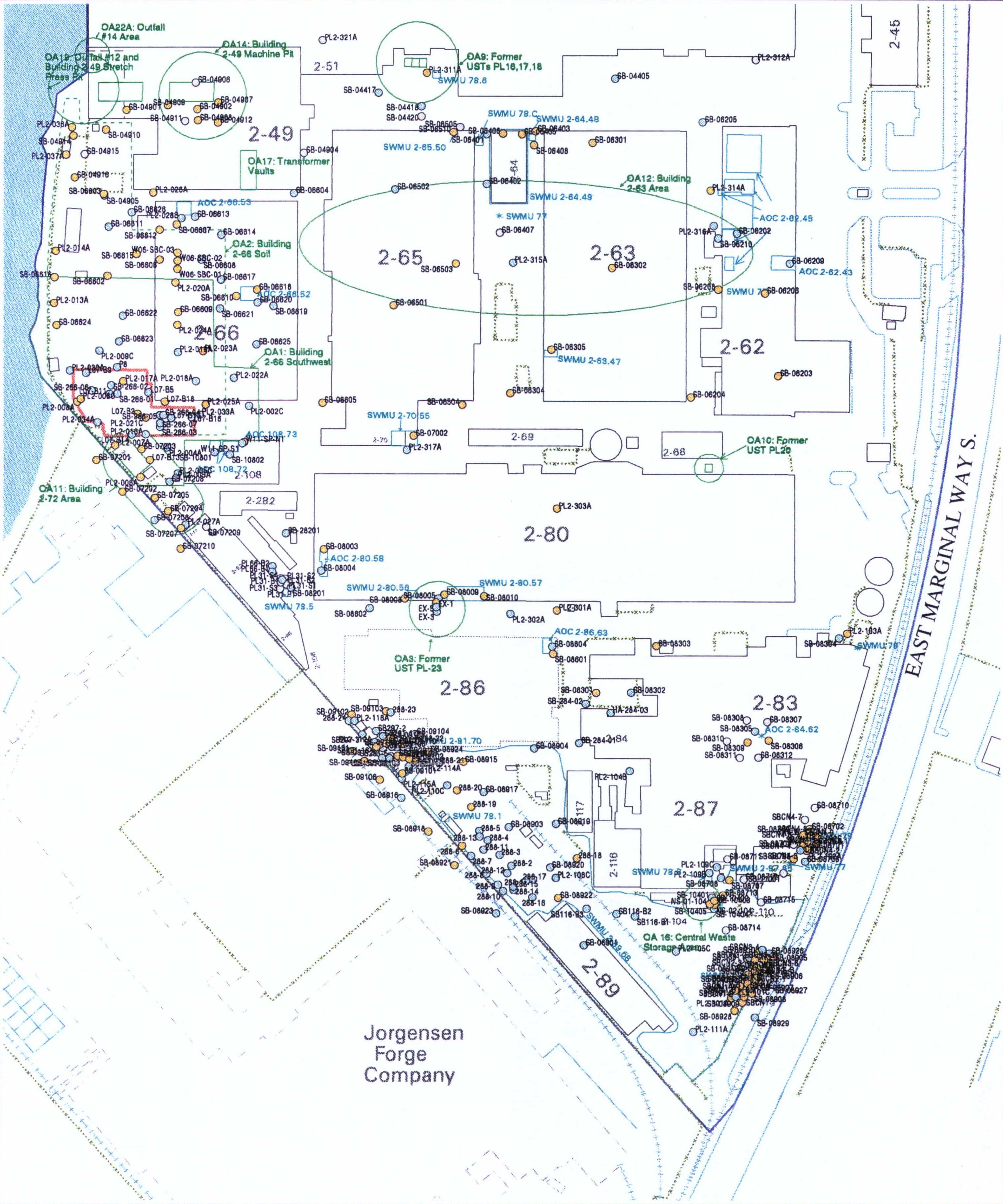
DATE: December 11, 1996 11:01 AM
JOB NUMBER: 03709-034-300-3810-02
LEAD GIS ANALYST: K. Palmer
VIEW FILE: default.view

CHECKED BY: ________

APPROVED BY: KAP

Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Map 1b

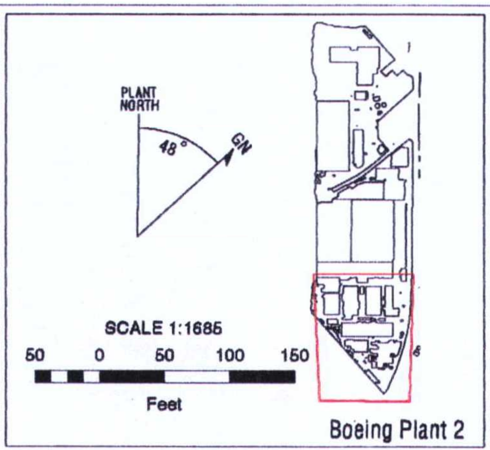


BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment

SYMBOL EXPLANATION

- Non-Detect
- Soil locations not exceeding PMCLs
- Soil locations exceeding PMCLs
- SWMU/AOC
- Approx. located SWMU/AOC
- Other Area
- Other Area



NOTES

1) Historical and RFI Soil Depths: 0 - 12 feet

WESTON
MANAGERS DESIGNERS/CONSULTANTS

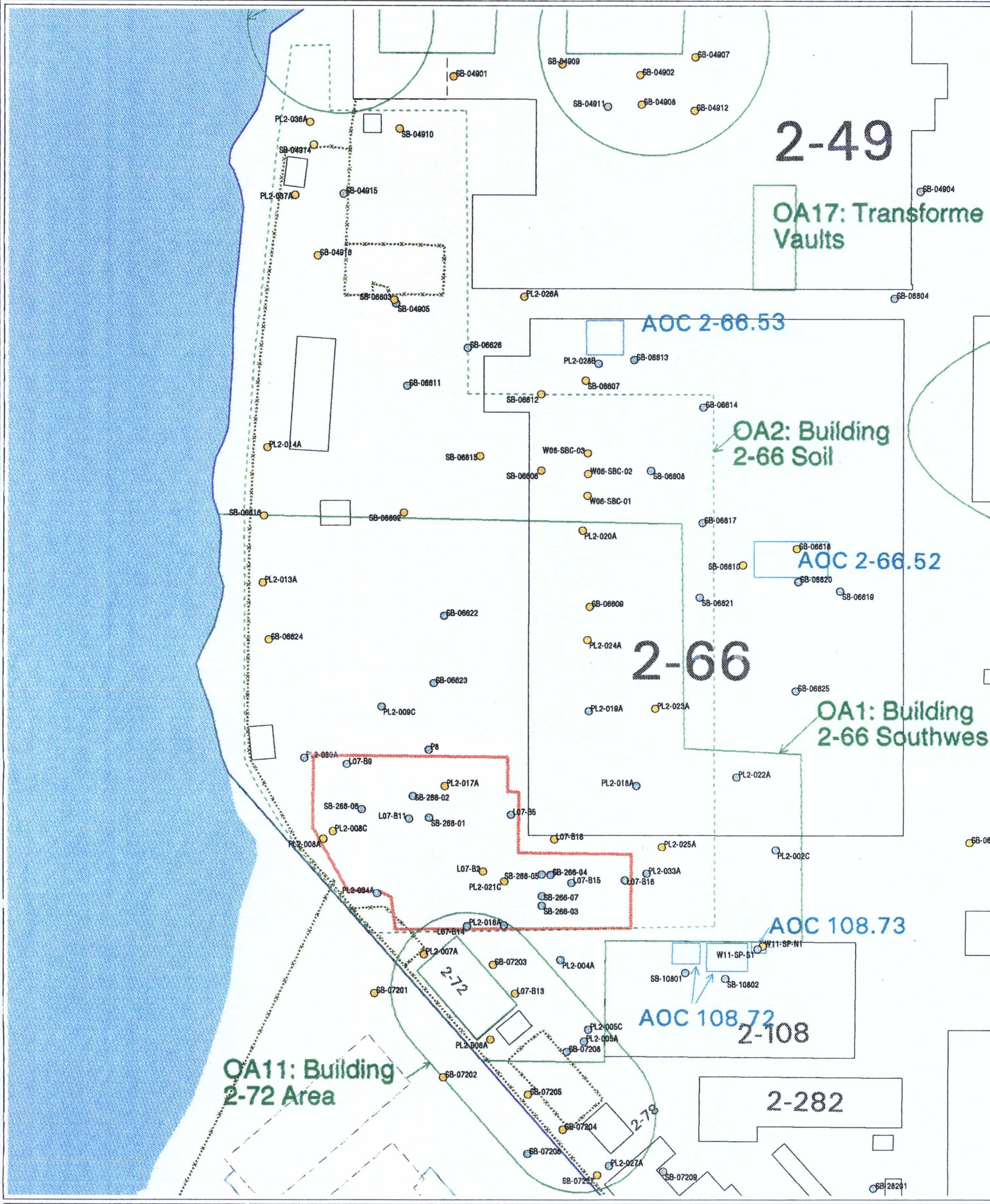
DATE: December 11, 1996 11:16 AM
JOB NUMBER: 03709-034-300-3810-02
LEAD GIS ANALYST: K. Palmer
VIEW FILE: default.view

CHECKED BY: ______

APPROVED BY: KAP

Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Map 1c

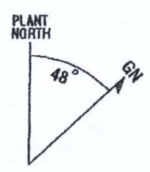


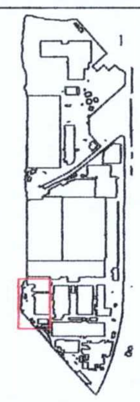
BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment

SYMBOL EXPLANATION

- Non-Detect
- Soil locations not exceeding PMCLs
- Soil locations exceeding PMCLs
- SWMU/AOC
- Approx. located SWMU/AOC
- Other Area
- Other Area





SCALE 1:632

10 0 10 20 30 40 50

Feet

Boeing Plant 2

NOTES

1) Historical and RFI Soil Depths: 0 - 12 feet

WESTON
MANAGERS DESIGNERS/CONSULTANTS

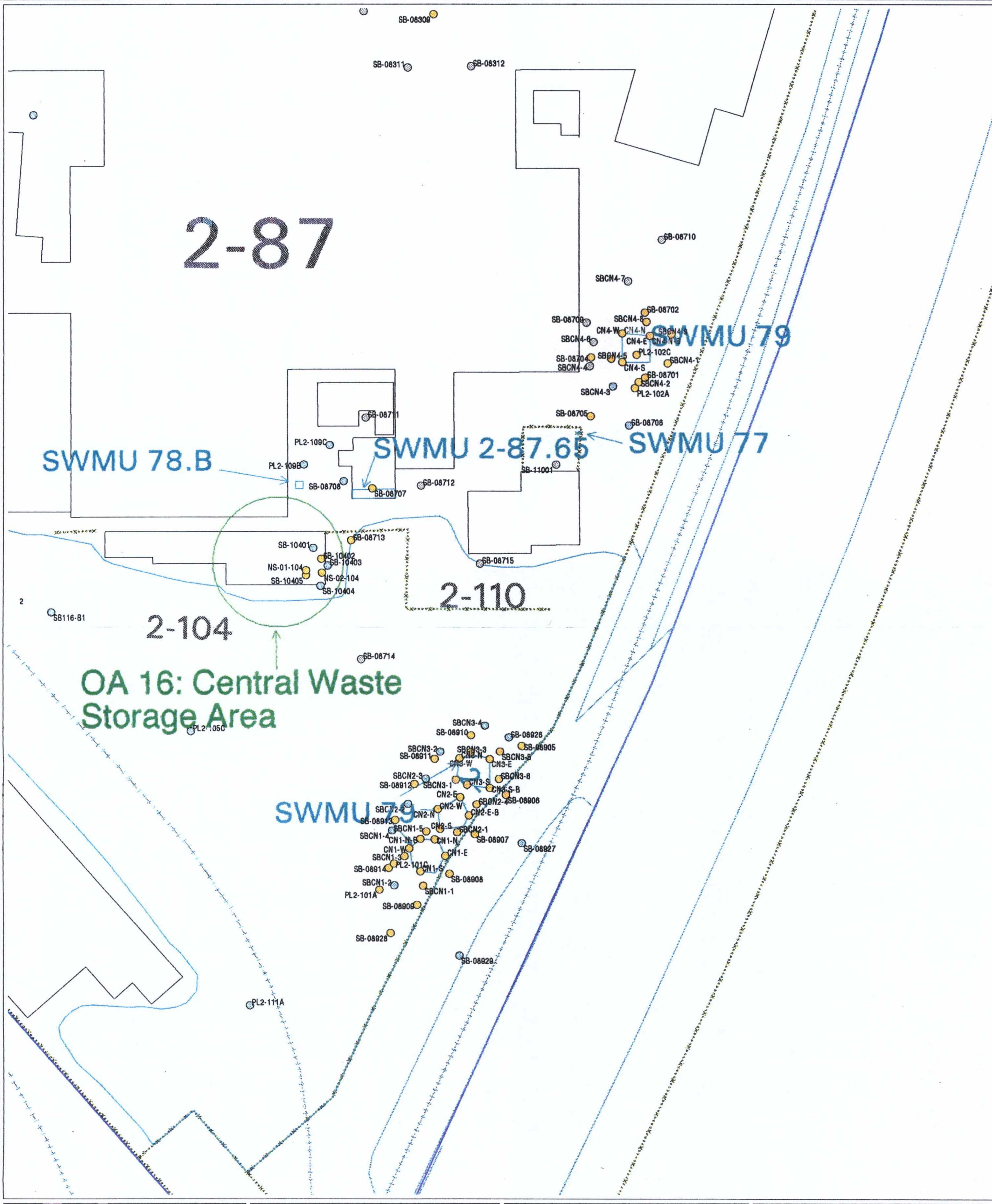
DATE: December 11, 1996 11:32 AM
JOB NUMBER: 03709-034-300-3810-02
LEAD GIS ANALYST: K. Palmer
VIEW FILE: default.view

CHECKED BY: ____________

APPROVED BY: KPP

Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Map 1d

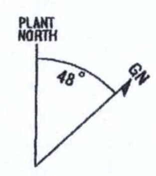


BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment

SYMBOL EXPLANATION

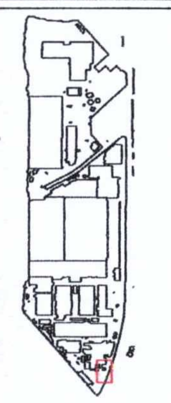
- Non-Detect
- Soil locations not exceeding PMCLs
- Soil locations exceeding PMCLs
- SWMU/AOC
- Approx. located SWMU/AOC
- Other Area
- Other Area



SCALE 1:491

5 0 5 10 15 20 25

Feet



Boeing Plant 2

NOTES

1) Historical and RFI Soil Depths: 0 - 12 feet

WESTON

MANAGERS DESIGNERS/CONSULTANTS

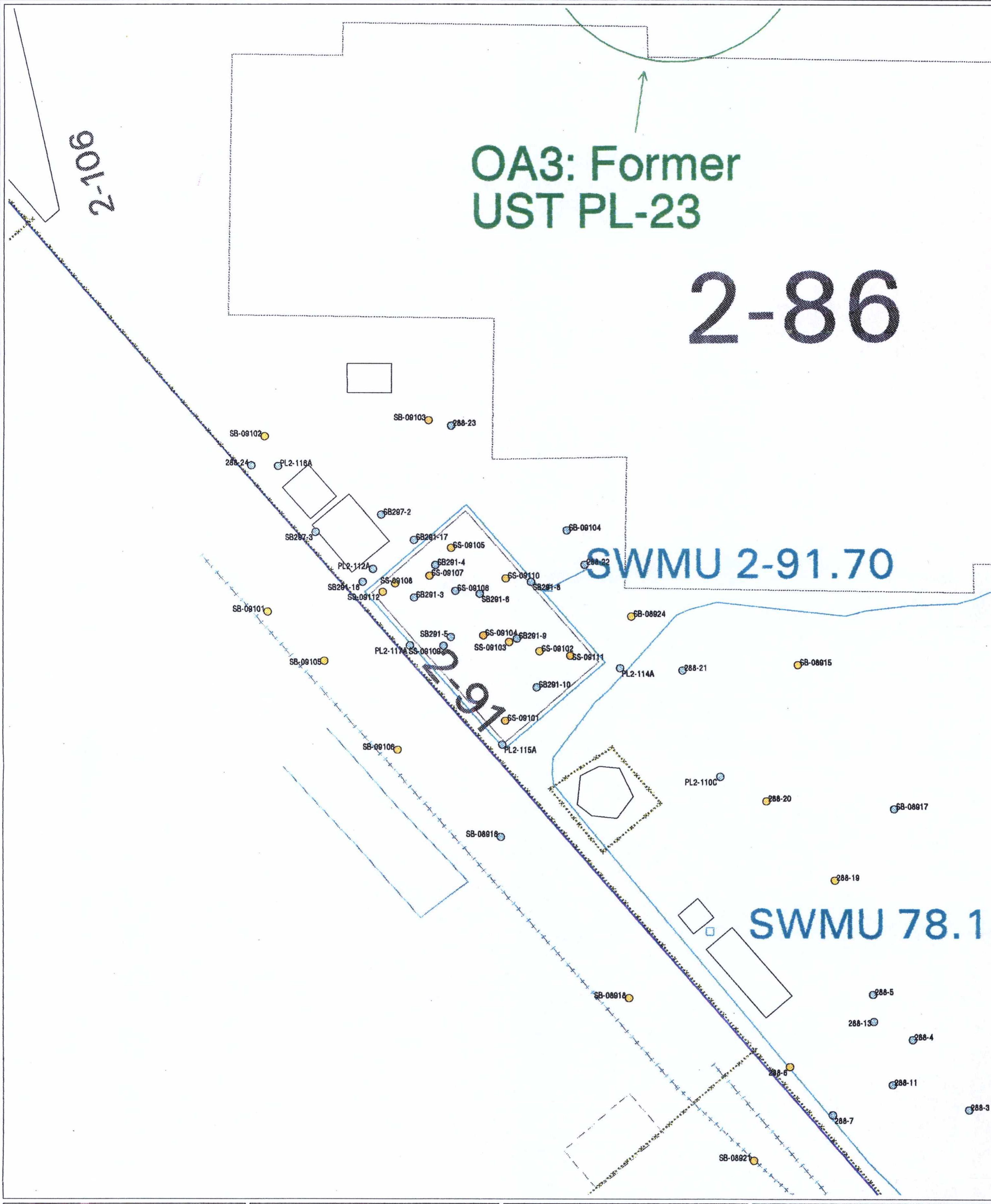
DATE: December 11, 1996 11:46 AM
JOB NUMBER: 03709-034-300-3810-02
LEAD GIS ANALYST: K. Palmer
VIEW FILE: default.view

CHECKED BY: ____________

APPROVED BY: KAP

Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Map 1e

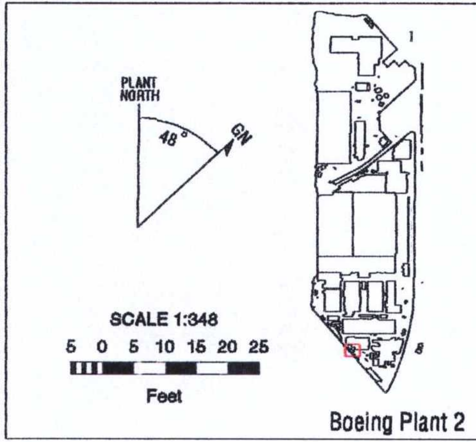


BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment

SYMBOL EXPLANATION

- Non-Detect
- Soil locations not exceeding PMCLs
- Soil locations exceeding PMCLs
- SWMU/AOC
- Approx. located SWMU/AOC
- Other Area
- Other Area



NOTES

1) Historical and RFI Soil Depths: 0 - 12 feet

WESTON
MANAGERS DESIGNERS/CONSULTANTS

DATE: December 11, 1996 12:00 PM
JOB NUMBER: 03709-034-300-3810-02
LEAD GIS ANALYST: K. Palmer
VIEW FILE: default.view

CHECKED BY: ______

APPROVED BY: KAP

Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Map 1f